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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| (51) International Patent Classification 6 : | | (11) International Publication Number: WO 96/15633 |
|---|---|---|
| H04Q 3/00, H04M 3/42 | A1 | (43) International Publication Date: 23 May 1996 (23.05.96) |

(21) International Application Number: PCT/FI95/00615

(22) International Filing Date: 10 November 1995 (10.11.95)

(30) Priority Data:

| | | |
|---|---|---|
| 945340 | 11 November 1994 (11.11.94) | FI |
| 945368 | 14 November 1994 (14.11.94) | FI |

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(81) Designated States: US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

**Published**

*With international search report.*

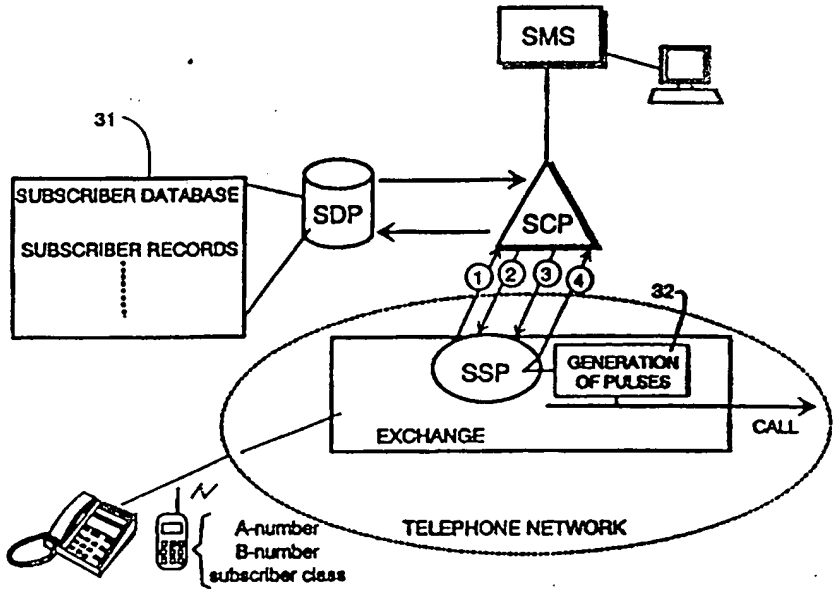
*Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.*

*In English translation (filed in Finnish).*

(54) Title: SYSTEM FOR SUBSCRIBER ADMINISTRATION IN TELECOMMUNICATION NETWORK

(57) Abstract

A system according to the invention comprises a subscriber administration logic located at a service control point SCP of an intelligent network, and a subscriber database of a service data point SDP that is associated therewith by CCS signalling. Subscriber records of the subscriber database are created, updated and deleted by the operator, but the create, read/write and delete functions can also be performed via a telephone network associated with the intelligent network. The operator can activate the control without that the subscriber notices it. For example, as a visitor subscriber of a mobile phone network is updated to a mobile phone network, the subscriber data are automatically forwarded to the intelligent network, which creates a subscriber record for the subscriber concerned. From the exchange performing call control, charging pulses (4) generated during the call are forwarded to the service control point SCP in the manner defined by a monitoring request sent by a service control function SCF, the service control point calculating the real time charges for the call. The current charges are compared with the value indicated by the subscriber record (31), and the instructions contained in the record are followed. The system makes it possible to implement both call- and subscriber-specific restrictions in real time.



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# System for subscriber administration in telecommunication network

The invention relates to subscriber administration in a telephone network from which there is access to an intelligent network.

The need to support and provide different services has led the development of telecommunication networks in the direction of what is known as an Intelligent Network IN. An intelligent network can be defined as architecture that is applicable to most telecommunication networks, irrespective of network technology. The aim is to create, control and manage teleservices giving added value. One characteristic of the intelligent network is to provide modular functions that are independent of a service used and can be connected to one another as components when new services are provided, which makes it easier to define and design new services. Another characteristic is that the supply of services is independent of the telecommunication network. The services are separate from the lowest physical network structure, whereby they may be distributed.

In recommendation CS-1 (Capability Set 1), CCITT defines an Intelligent Network Conceptual Model INCM. The model consists of four levels, each of which represents an abstract view of the possibilities offered by the intelligent network. The second highest level in the model is a Global Functional Plane, and it includes the view of the intelligent network as Service Independent Building Blocks SIB, from which desired features of a service and desired services are assembled by the use of service logic. This level also comprises a Basic Call Process BCP, which covers the whole network, and a Point of Initiation POI and a

Point of Return POR between BCP and SIB.

The physical architecture of the intelligent network is shown in fig. 1. A Service Switching Point SSP gives the user access to the network and makes all the necessary selections. It is able to detect the service requests of the intelligent network. Operationally, SSP contains call management and service selection functions. A Service Control Point SCP comprises the programs of the service logic that are used for producing intelligent network services. A Service Data Point SDP contains the data that the programs of the SCP service logic use to produce individualized services. SCP and/or SMP can use the services of SDP either directly or via a signalling network that uses an INAP protocol. Supplementary services offered by an Intelligent Peripheral IP include e.g. voice messages, synthetic voice and speech detection means, and voice generation. A Service Switching and Control Point SSCP consists of SCP and SSP in one node. A Service Management Point controls the service management, supply and performance, and can be connected to all other physical entities. Examples for the operation include database management, network control and testing, network traffic management, and network data collection. A Service Creation Environment Point SCEP is used for defining, developing and testing intelligent network services, and for supplying the service to SMP. An Adjunct AD corresponds operationally to the service control point SCP but is connected directly to SSP. A Service Node SN can control the intelligent network services, and it communicates with the users. It communicates directly with one or more SSPs. A Service Management Access Point SMAP is a physical entity that provides certain users with a connection to SMP.

A Basic Call State Model BCSM defined in connection with the intelligent network is a description of the facilities of the call management function needed for setting up and maintaining a connection between users. It detects the points (detection point) in the call and connection process in which the IN service logic entities can interact with the basic call and connection management functions. It provides a basis for describing the basic call and connection actions that may lead to activation of an IN service logic entity and description of the points where the transfer of the control may be performed.

Fig. 2 illustrates one known basic service in an intelligent network, i.e. number conversion service. Only essential physical entities are shown in the figure. The subscriber inputs e.g. the number 800+ABCD (ABCD is a number sequence). Upon detecting the prefix 800, the call control function of the exchange identifies the call as an intelligent network call, whereby it requests for an intelligent network service via the intelligent network Service Switching Point SSP. Using common channel signalling, it sends the control point SCP an inquiry containing the number 800+ABCD. The service program of the SCP checks the SDP file to see what number of a conventional telephone network corresponds to the number 800+ABCD. In this example, the number is 291 7041. SCP sends this number to SSP, which forwards it to the call control of the exchange, which then routes the call to the number concerned. In sending the number to SSP, SCP also sends charging information on the call. The exchange generates pulses during the call, and the call is later charged for on the basis of these pulses and the charging information provided by SCP.

Another example for an intelligent network

service is Automatic Alternative Billing AAB. It makes it possible for the user to make a call from any phone whatsoever, the call being later debited against the user's account, which is maintained by the operator, and the charging being implemented as aftercharging. The provider of the service allocates an Account Code to the user of the service, and a Personal Identification Number PIN. The service will be activated as the user inputs the access code, followed by the number that the user wants to call. SSP identifies the access code and transfers the control to SCP. SCP asks the user to input the account code and PIN. The code and PIN inputted by the user are checked by a database inquiry, after which the call is connected. The bill for the call is formed afterwards on the basis of the charging information provided by SCP and the pulses generated by the exchange and indicating the duration of the call.

Irrespective of the fact whether the subscriber uses the intelligent network service or not, and whether he is a mobile subscriber or a fixed network subscriber, it is typical of the present telephone systems that different subscriber databases are used and that call- and subscriber-specific charging is implemented as aftercharging. A fixed network typically uses the subscriber database of an exchange; and a mobile phone network, such as a GSM network, uses a Home Location Register HLR, in which permanent subscriber data are stored. The above-mentioned AAB service uses a database of an intelligent network, the database containing the account number and PIN.

The feature common to all these subscriber databases is that they are created and updated by the operator of the network concerned. As known, different

subscriber-specific parameters can be set in the database. For example, the network operator can set in the subscriber record a parameter that prevents the subscriber from making e.g. international calls or denies access to certain services implemented by means of an intelligent network, e.g. entertainment services. Entertainment services implemented by an intelligent network have proved particularly problematic, and so it has been possible to set a certain time limit at which the call will be terminated.

In view of the above, subscriber administration of the present networks seems to involve some problems. It is not possible to include a parameter that would prohibit over-expensive calls in the subscriber databases, since the subscriber is never charged until afterwards, after the call. The only possibility is to deny access altogether to numbers that begin with certain prefixes. Since it is not possible to receive real time information about an on-going call made by a subscriber, e.g. charging information and statistical data, the calls of a so-called problem subscriber cannot be controlled during the call. In mobile phone networks, it is at present not possible to separately control visitor subscriber traffic, but a visitor subscriber coming from another network can make phone calls and leave them unpaid, thereby making the operator suffer losses. A time limit for entertainment services, implemented in intelligent networks, is specific for the call and thereby applies to all calls to an entertainment number, so it does not prevent the subscriber from dialling service a plural number of times, since subscriber-specific or subscriber-connection-specific control has so far not been possible.

The present invention provides a system that

eliminates the above problems. The system is characterized by what is disclosed in claim 1.

The system comprises specific subscriber administration logic provided at the service control point SCP of the intelligent network. The database is physically located at the service data point SDP. Subscriber records of the subscriber database are created and deleted by the operator via a service management system SMS, but according to one characteristic of the invention, subscriber records are also created and deleted via a telephone network associated with the intelligent network. The create, read/write and delete functions conducted via the telephone network are automatic. For example, when a visitor subscriber of a mobile phone network is updated to a mobile phone network, the subscriber data are automatically forwarded to the intelligent network, which creates a subscriber record for the subscriber concerned. According to another characteristic of the invention, charging pulses generated during the call are transmitted from the exchange performing call control to a service control exchange in the manner defined by a monitoring request sent by a Service Control Function SCF, the latter exchange indicating the current, real-time charges for the call. The current charges are compared with the value given in the subscriber record, and the instructions provided by the record are followed.

In the following, the invention will be described in greater detail with reference to the attached schematic drawings, in which

fig. 1 shows physical architecture of an intelligent network,

fig. 2 illustrates a number conversion service in an intelligent network,

fig. 3 shows an intelligent network supplemented with a system according to the invention,

fig. 4 is a flow diagram of how subscriber charging is monitored, and

fig. 5 is a flow diagram showing transactions when a call is made using a prepaid card.

The broken line in fig. 3 defines a telecommunication network comprising an exchange. A telecommunication network may be a fixed network or a mobile phone network. To a digital exchange is connected a service switching point SSP of the intelligent network, the point detecting the requests of the intelligent network service. Operationally, SSP corresponds to a Service Switching Function SSF, which connects a Call Control Function CCF and the service control function SCF. It allows SCF to control CCF. The basis for a service request may be the number of a B-subscriber dialled by an A-subscriber, who may be a fixed network subscriber or a mobile subscriber, or the number or subscriber class of the A-subscriber. On the basis of the number of the B-subscriber, e.g. an international call can be controlled in the intelligent network in the manner described in the invention. On the basis of the number of the A-subscriber, it is possible to detect e.g. a foreign subscriber visiting a GSM mobile phone network. When the MSISDN number of the subscriber shows that the subscriber is a visitor, all his calls are controlled by the intelligent network service. When the subscriber class indicator shows that the subscriber uses an intelligent network service, e.g. an entertainment number beginning with 700, call control is also transferred to the intelligent network. On the basis of the subscriber class, all calls of any given group can be subjected to the control of the intelligent network, e.g. all GSM subscribers, NMT

subscribers, VPN connections (Virtual Private Network), etc.

At the service control point SCP of the intelligent network, physically at the service data point SDP, there is a database 31 comprising subscriber-specific information in an individual subscriber record. The record thus contains at least the A-number and information on the balance. In addition to these, the record may comprise e.g. black/white information, the abbreviated number of the subscriber, statistical data, and instructions. The statistical data may indicate the number of calls made by the subscriber, the number he has dialled, call durations, etc. The instructions indicate how to perform when certain conditions are met. Such a condition may be e.g. that predetermined charges are exceeded. The basic database is created by the operator via the service management system SMS. According to the invention, records can also be created and deleted automatically by the telecommunication network. For example, when a visiting mobile subscriber updates location data in the network, SSP identifies him by the MSISDN number as a visitor and forwards the number to SCP, which immediately creates a separate record for the visitor number and sets the fields containing desired information therein. After this, all calls of a visiting GSM-subscriber are controlled by SCP.

When a subscriber whose calls are to be controlled dials a number, the A-number of the subscriber is forwarded to the intelligent network, and so is the B-number, at least when it is subjected to number conversion in the intelligent network (cf. fig. 2). This is indicated by the arrow marked with a circled one. If the call uses an intelligent network service, e.g. an entertainment service, SCP sends the

exchange routing instructions and charging information. The former is indicated by an arrow marked with a circled two, and the latter by an arrow marked with a circled three. When the call has been routed to a B-subscriber and a speech connection is established, pulses are generated in a pulse generator 32. In prior art systems, the exchange calculates the charges of the call afterwards on the basis of the charging information and the pulses generated during the call. In a system of the invention, charging pulses generated during the call are forwarded to the service control point SCP in the manner defined by a monitoring request sent by a service control function SCF. The monitoring requests are responded to by the service switching function SSF. This is indicated by an arrow marked with a circled four. On the basis of the pulses and the charging information, SCP calculates the charges for the call in real time as the call progresses. SCP has fetched the subscriber data from the database of the subscriber record of the A-subscriber, and if the data includes information about the charges of the call, e.g. the maximum charges allowed, the call will be disconnected accordingly, or another procedure will be followed. This other procedure is also indicated in the record. The record may give instructions to send the subscriber a voice message indicating e.g. that the call will be disconnected in a moment or that the upper limit set for the charges has been reached.

The subscriber record may comprise subscriber data or conditions relating to them. If, for example, SCP detects that the subscriber attempts to call a certain number more often than allowed, the call will not be connected, and the subscriber will be notified accordingly.

Fig. 4 is a flow diagram of how charging is

monitored. At first, as a certain trigger condition is met, the subscriber's call signal is forwarded to the intelligent network by the service switching point SSP associated with the exchange. Different trigger conditions have been described above. Upon receiving the subscriber's call signal, SCP checks whether the subscriber's data are found in the database 31 (fig. 3). If they are not found, SCP registers the subscriber by creating a separate subscriber record for it and inputs the A-number of the subscriber in the record. After this, when a speech connection has been established between the subscribers, charging pulses are supplied from the exchange to SCP. It calculates the charges for the call cumulatively during the call, and compares the accumulated charges with the alarm limit indicated in the database. When the alarm limit is reached, managed further processing follows. The instructions for the further processing may be general or specific for the subscriber. In the latter situation, the instructions are included in the subscriber record. According to them, the operator can be instructed to transfer the call to SSP, which notifies the subscriber that the call is about to be disconnected, or the instructions may also indicate some other desired function.

Fig. 5 shows how the method of the invention can be applied to controlling calls that are paid with a prepaid card. This makes it possible for the user to call from any phone whatsoever, and yet the call will be charged against the user's account, which has a certain pre-set balance. The user of a service has an Account Code and a Personal Identification Number PIN. The call signal of the subscriber is triggered to SCP using the account code, A-number or B-number as a trigger key. The authority is checked on the basis of

the A-number, mobile phone number MSISDN or personal identification number PIN of the subscriber, or on the basis of something else. SCP checks the subscriber database to see the current balance of the subscriber and notifies the subscriber by a voice message or on the display of the subscriber station. If the account is empty, the call procedure is released, and if the balance is positive, the call is connected. If a subscriber replies, charging is started on the basis of the charging information and the pulses received from the exchange. In addition, the call can be monitored in respect of other conditions indicated in the subscriber record. At the end of the call, the subscriber's account shows the real time balance, and if the account is empty, the desired further processing follows. The instructions for this can also be included in the subscriber database.

The system of the invention allows many different applications. It can be used for controlling pre-paid calls possibly involving restrictions or other services. Call-specifically, it is also possible to restrict the duration of one call on the basis of the charges, and subscriber-specific call control is easy to implement. For example, the total number of calls that a subscriber can make can be restricted. The subscriber can be registered automatically by the telecommunication network to the subscriber database, and this can be implemented without that the subscriber notices it. For example, GSM visitor subscriber traffic can be controlled thereby, and so visiting subscribers cannot incur bad debts to the operator. Calls of so-called problem subscribers are easy to control, and real time information can be obtained easily on them, so necessary steps can be taken in time in respect of the subscriber concerned.

The above description and the accompanying figures are only intended to illustrate the present invention. It is obvious to one skilled in the art that the invention can be varied and modified in many ways without deviating from the scope and spirit of the invention disclosed in the attached claims.

## Claims

1. A system for subscriber administration in a telephone network having an exchange to which is connected a service switching point SSP of an intelligent network IN, the service switching point providing access from the telephone network to the services offered by a service control point SCP of the intelligent network, c h a r a c t e r i z e d in that

the service data point SDP associated with the service control point SCP comprises the database of the subscribers to be managed, an individual subscriber record of the database comprising at least the A-number of the subscriber and other data on the subscriber,

when the service switching point SSP has routed the call signal of a new subscriber to be managed to the intelligent network, the subscriber administration logic at the service control point SCP immediately creates in the database a subscriber record for the new subscriber,

charging pulses generated by the exchange are forwarded during the call to the service control point SCP in the manner defined by a monitoring request sent by a service control function SCF, the service control point calculating the charges for the call during the call on the basis of the charging pulses and the charging information about the call given by the service control point SCP, whereby the real time charges for the call are known.

2. A system according to claim 1, c h a r - a c t e r i z e d in that the new subscriber to be managed is a mobile subscriber visiting the mobile phone network, a separate subscriber record being created for the subscriber in connection with location

updating, and that the service control point SCP controls all the calls of the visiting mobile subscriber with the help of the information contained in the subscriber record.

3. A system according to claim 1, c h a r - a c t e r i z e d in that the other subscriber data of the subscriber record contains information about the balance set for the subscriber by the operator, and that the balance is reduced in real time in accordance with the charges incurred during the call.

4. A system according to claim 1, c h a r - a c t e r i z e d in that the other subscriber data of the subscriber record contains information about the balance set by the operator for one call made by the subscriber, and that the balance is reduced in real time according to the costs incurred during the call, and as the balance reaches zero, the speech connection is released in a controlled manner.

5. A system according to claim 4, c h a r - a c t e r i z e d in that a balance for one call is applied only when a speech connection is established to predetermined B-subscriber numbers that are indicated in the subscriber record.

6. A system according to claim 1 or 4, c h a r a c t e r i z e d in that the other subscriber data of the subscriber record contains information about the allowed number of calls set by the operator for one subscriber, and that as the number of calls exceeds the allowed number, no speech connection is established.

7. A system according to claim 6, c h a r - a c t e r i z e d in that the allowed number is applied only when a speech connection is established to a predetermined B-subscriber number, which is indicated in the subscriber record.

8. A system according to claim 1, c h a r - a c t e r i z e d in that the other subscriber data of the subscriber record contains statistical data about the calls of the subscriber, the operator being able to use these data to control and manage the calls of the subscriber.

9. A system according to claim 3, c h a r - a c t e r i z e d in that

the other subscriber data of the subscriber record contains information about the balance set by the operator for the subscriber, and as the subscriber calls a common call number and inputs his identification data, he is informed of the current balance,

when the subscriber has inputted the number of the B-subscriber and the speech connection has been established, the balance is reduced in real time, whereby the subscriber can call from any subscriber connection whatsoever without that the connection concerned is charged.

10. A system according to claim 4 or 6, c h a r a c t e r i z e d in that when the balance reaches zero or the number of calls exceeds the allowed number, the intelligent network sends the calling subscriber and optionally also the called subscriber a voice message.

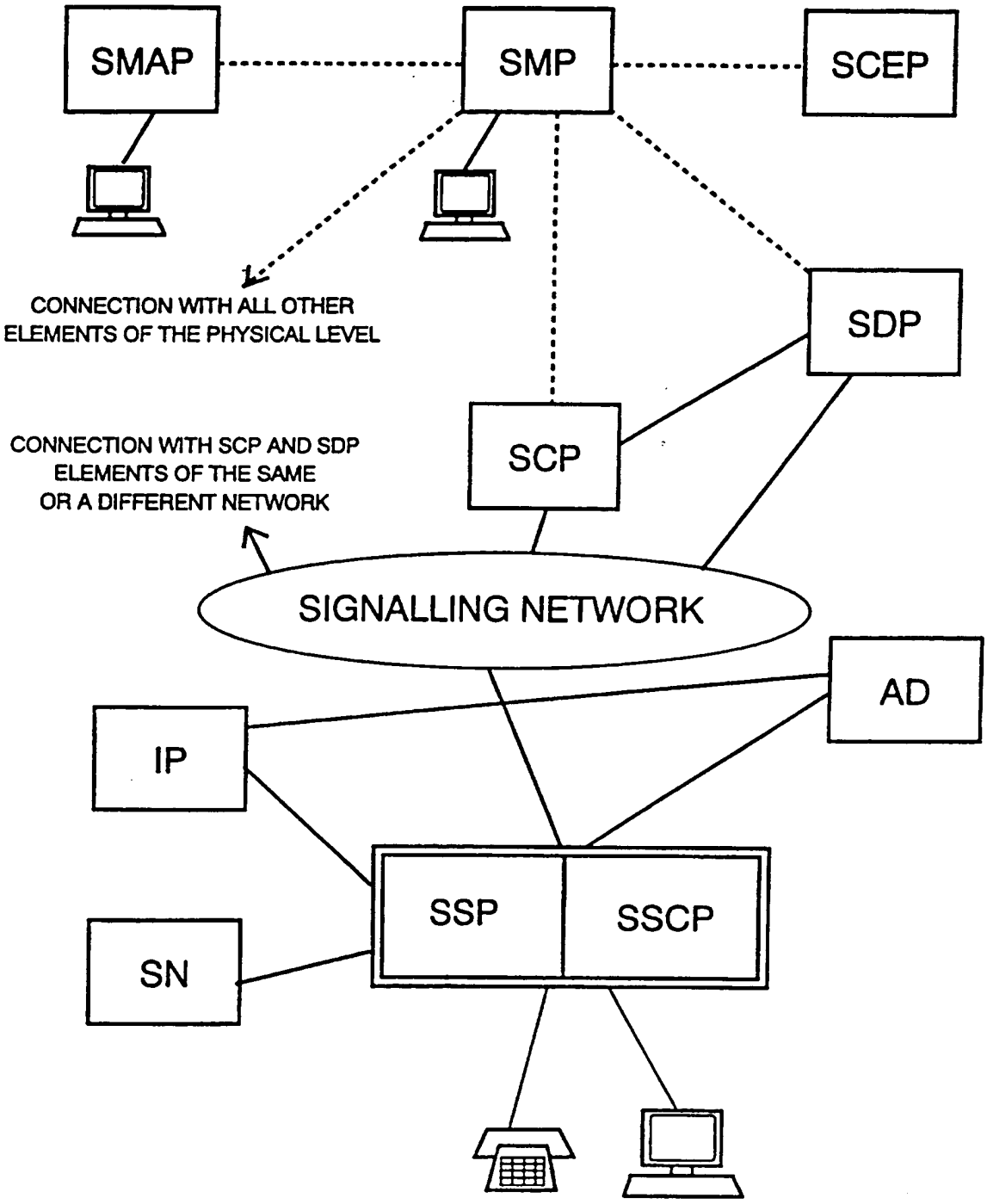
SMAP
SMP
SCEP
CONNECTION WITH ALL OTHER ELEMENTS OF THE PHYSICAL LEVEL
SDP
SCP
CONNECTION WITH SCP AND SDP ELEMENTS OF THE SAME OR A DIFFERENT NETWORK
SIGNALLING NETWORK
AD
IP
SSP
SSCP
SN

FIG. 1

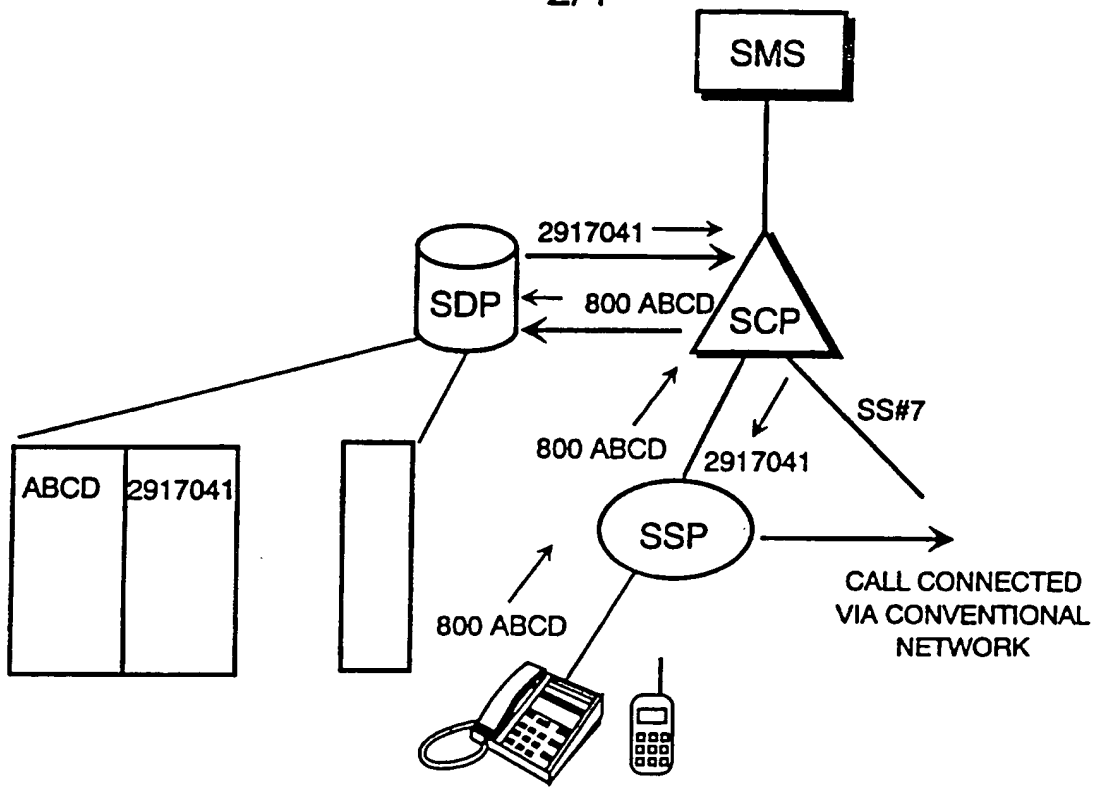
SMS
2917041
SDP
800 ABCD
SCP
SS#7
800 ABCD
2917041
ABCD
2917041
SSP
CALL CONNECTED
VIA CONVENTIONAL
NETWORK
800 ABCD

FIG. 2

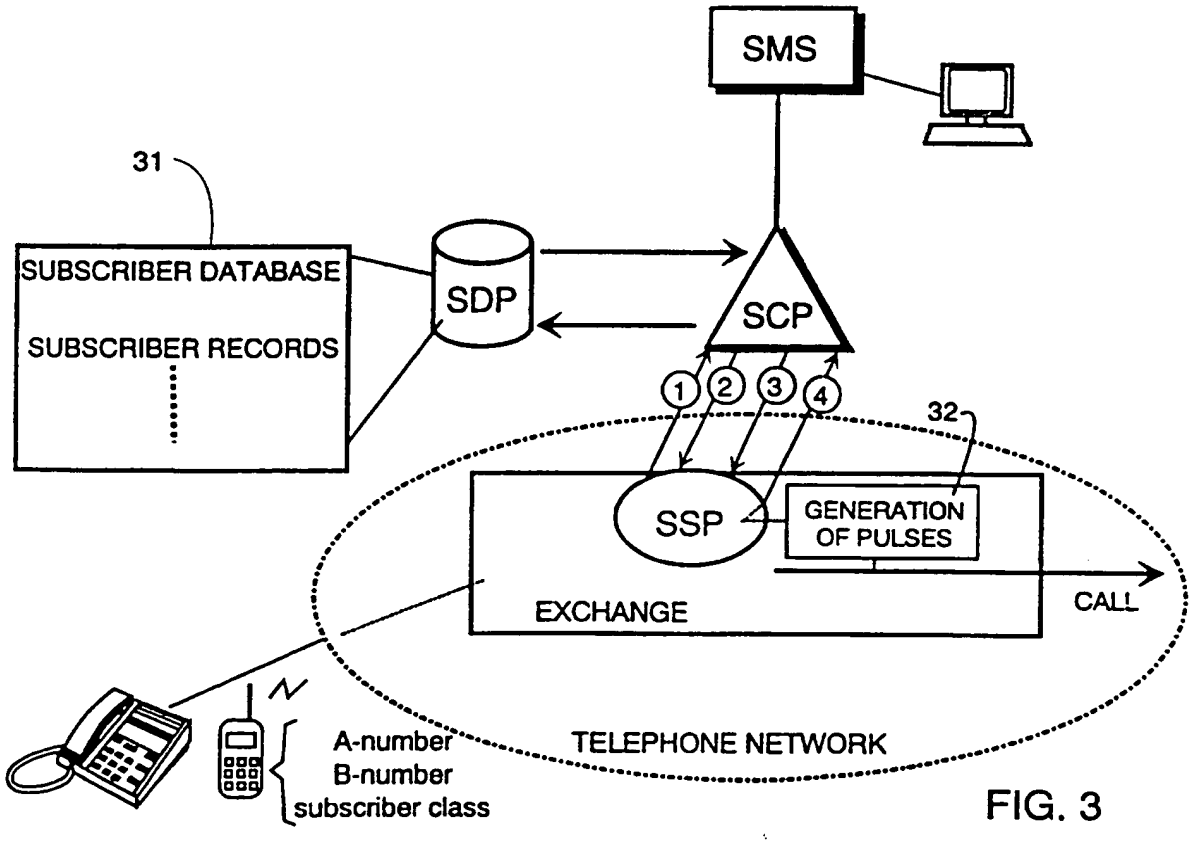
SMS
31
SUBSCRIBER DATABASE
SUBSCRIBER RECORDS
SDP
SCP
1
2
3
4
32
SSP
GENERATION
OF PULSES
EXCHANGE
CALL
A-number
B-number
subscriber class
TELEPHONE NETWORK

FIG. 3

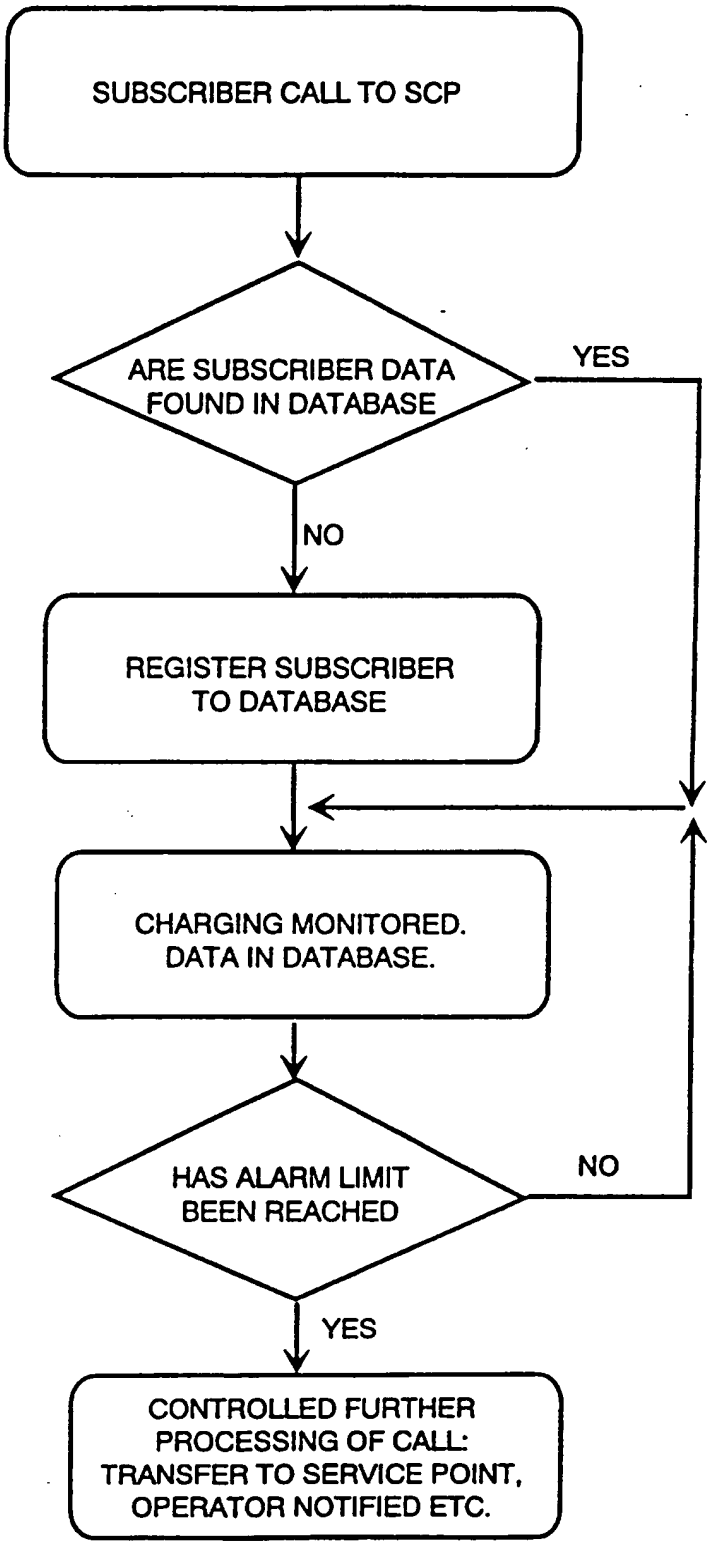
SUBSCRIBER CALL TO SCP
ARE SUBSCRIBER DATA FOUND IN DATABASE
YES
NO
REGISTER SUBSCRIBER TO DATABASE
CHARGING MONITORED. DATA IN DATABASE.
HAS ALARM LIMIT BEEN REACHED
NO
YES
CONTROLLED FURTHER PROCESSING OF CALL: TRANSFER TO SERVICE POINT, OPERATOR NOTIFIED ETC.

FIG. 4

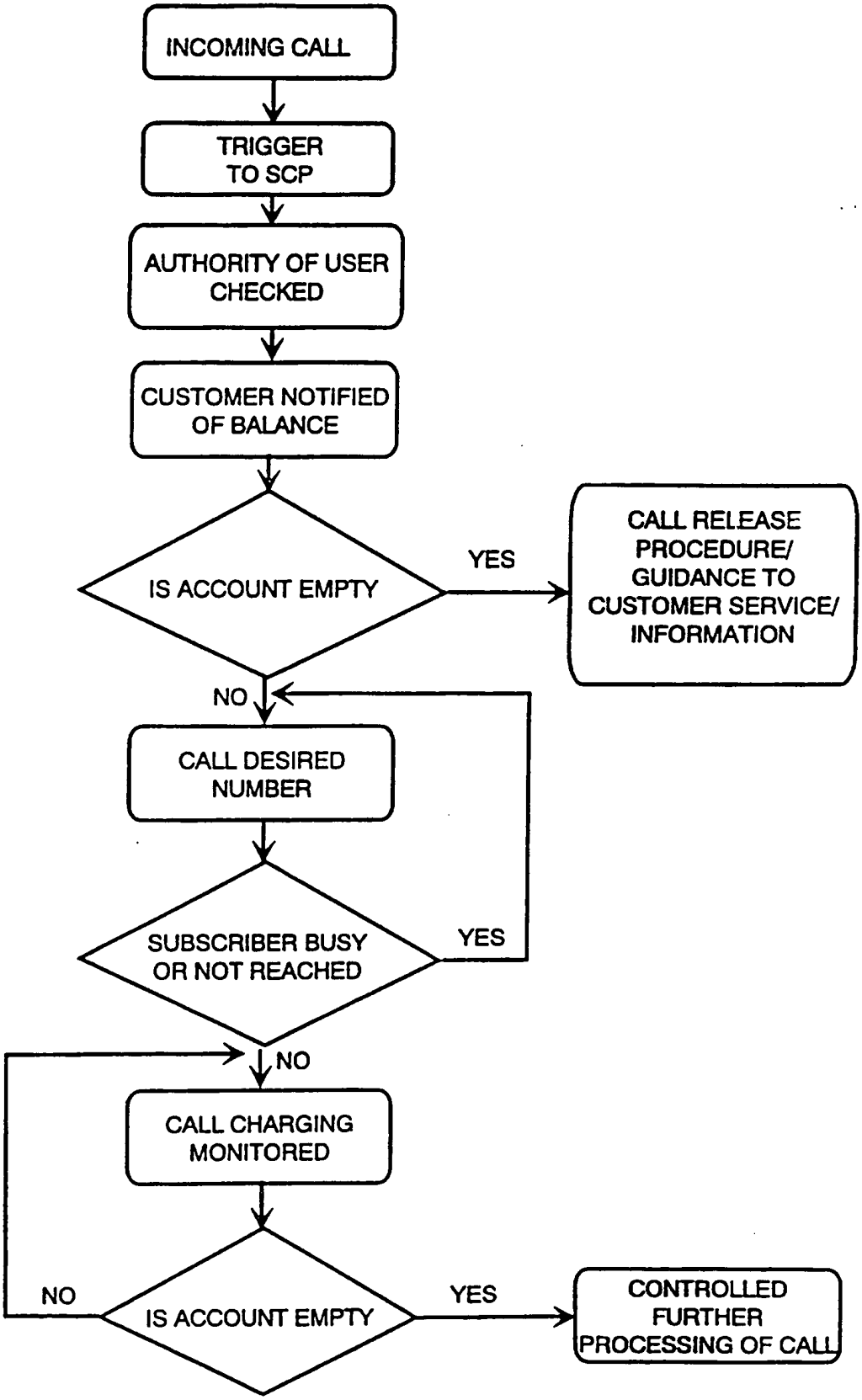
INCOMING CALL
TRIGGER TO SCP
AUTHORITY OF USER CHECKED
CUSTOMER NOTIFIED OF BALANCE
IS ACCOUNT EMPTY
YES
CALL RELEASE PROCEDURE/ GUIDANCE TO CUSTOMER SERVICE/ INFORMATION
NO
CALL DESIRED NUMBER
SUBSCRIBER BUSY OR NOT REACHED
YES
NO
CALL CHARGING MONITORED
IS ACCOUNT EMPTY
NO
YES
CONTROLLED FURTHER PROCESSING OF CALL

FIG. 5

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 95/00615

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 3/00, H04M 3/42
According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q, H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPIL

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| A | US 5206899 A (ALOK K. GUPTA ET AL), 27 April 1993 (27.04.93), column 2, line 46 - column 3, line 44; column 4, line 30 - line 40 | 1 |
| A | EP 0452591 A2 (AMERICAN TELEPHONE AND TELEGRAPH COMPANY), 23 October 1991 (23.10.91), column 1, line 57 - column 3, line 1 | 1 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 26 April 1996 | 26 -04- 1996 |
| Name and mailing address of the ISA/<br>Swedish Patent Office<br>Box 5055, S-102 42 STOCKHOLM<br>Facsimile No. +46 8 666 02 86 | Authorized officer<br>Göran Magnusson<br>Telephone No. +46 8 782 25 00 |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

01/04/96

International application No.
PCT/FI 95/00615

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